CARNIVOROUS PLANT NEWSLETTER

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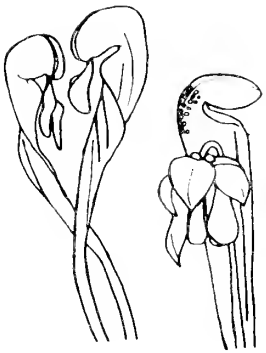

CARNIVOROUS PLANT NEWSLETTER

Official Journal of the International Carnivorous Plant Society

Volume 16, Number 1
March 1987

COVER PHOTO

The plant of *Nepenthes sanguinea,* grown by Ray Triplett, won Best of Show at the 1986 San Francisco Fair Flower Show.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Joanne Klingensmith, 437 Las Riendas, Fullerton, CA 92635. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the September issue is July 1, 1987.

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NEWS AND VIEWS

R.A. BARTLETT (7, Barbados Close, Safety Bay, W.A. 6169, Australia) writes:

I recently looked back through all the back issues of CPN and also the various carnivorous plant books that I have, namely: SLACK, SHIVAS, CHEERS, KONDO, and KONDO, OVERBECK and SHIGEO KURATA. My purpose was to list all the colour photographs of the different *Nepenthes* species that these sources contained.

At the end of the exercise I was surprised at the number of species for which I could not record a photograph - a total of 27 in fact. They are:

N. Anamensis
N. Belli
N. Boschiana
N. Burkeii
N. Campanulata
N. Deaniana
N. Decurrens
N. Densiflora
N. Dubia
N. Ephippiata
N. Geoffrayi
N. Globamphora
N. Inermis
N. Insignis
N. Klossii
N. Leptochila
N. Mollis
N. Muluensis
N. Neglecta
N. Neo-Guineesis
N. Northiana
N. Paniculata
N. Papuana
N. Pilosa
N. Spathulata
N. Tomoriana
N. Vieillardi

My reason for writing to you is to ask if the society has any photographs of these species. If so, could they be published in future issues? Also, perhaps if any members have a decent colour photograph they could submit it for publication. Certainly I, and I'm sure other members, would love to see what these species look like.

STEVE A. BODDY, (2312 Anndel Court, Grove City, OH 43123) writes:

Here is a slide of a *Genlisea hispidula* plant which was given to me by a friend. Several months after uprooting the plant to take photos, the plant died! It lost most of its leaves and sent up a flower stalk. The flowers never opened and the plant finally perished. I would guess that this species might be sensitive to disturbance.

Although my own experience with *Genlisea* is limited, I wanted to give you some information on my own and some information from other growers. I believe that the cultivation information is as correct as the limited experience of a few growers will allow at this time.

Genlisea species can be grown as an aquatic or as a terrestrial, and seems to be rare in cultivation because it's rarely collected, slow to reproduce and fragile. *G. hispidula* is native to S. Africa and doesn't seem to have seasonal growth periods or dormancy. It grows very slowly compared to many terrestrial *Utricularias,* as it produces an offshoot in 6-12 months. The plant grows as a rosette with new leaves coming out of the center of the plant. It can be divided when offshoots are large enough. It flowers twice a year and can be self-pollinated to produce seeds that take 3 months to ripen. Germination of the seed is unknown at this time. The flowers, which emerge on 2-5 stalks, are similar to *Utricularia* flowers with various shades of purple and brownish-purple color. *(Cont'd.)*

Uprooted *Genlisea hispidula*

Photo by S. Boddy

As far as cultural conditions, they are similar to those for terrestrial *Utricularia* in a mix composed of 80% peat and 20% sand. The growers seem to agree that the media should be soggy wet and has been grown under light and in a greenhouse with about 70% sunlight. One grower managed to grow it successfully for over two years.

I also wanted to mention that I found a source for seed of *Capsella bursa-pastoris,* mentioned in CPN 7 (3). It can be ordered from the catalogue put out by: Redwood City Seed Co., P.O. Box 361, Redwood City, CA 94064.

DAVID E. BUTLER (127 Wright Road, Concord, MA 01742) has just recently moved to this address and would appreciate hearing from any fellow CP enthusiasts in the New England region, particularly around Boston, who would like to correspond with him or visit. David has been busy exploring and has recently located a new site for *Sarracenia purpurea ssp. purpurea f. heterophylla* in the New England coastal area. Two plants appear well established with surrounding seedling activity in the tundra-like area. He has also noted some "near *heterophylla*" (intermediate) plants nearby which are not completely anthocyanin-free, but do have green sepals. In the winter, the pitchers turn a distinct bronze-red rather than the usual purple of common ssp. *purpurea.* He will be studying this area further.

JOSEPH P. CANTASANO (2726 Wallace Ave., N. Bellmore, NY 11710) writes:

Suffolk County, Long Island, on July 24, 1986 signed a landmark resolution authorizing the County to buy $60 million Parkland to preserve 5000 acres of open wetlands and swamps. In this bill, I am happy to report there are many bogs and swamps with large populations of CP which will be preserved.

For the last three summers, I have been correlating topography maps with a Suffolk County atlas (Hagstrom), to indicate localities of CP. I have used a color legend which is easier than writing in the names of the areas. The legend will read as follows:

Multi-colored dots indicate scattered species.
Circles indicate species found near the edge of a pond or bog.
Thickness of line represents degree of abundance.

I should have this map completed by the summer of 1987. In one bog, surprisingly close to the Riverhead County Center (Gov't. Bldgs.), I found a sphagnum bog with a rich population of *S. purpurea* which were highly colored. Also located in the same bog are *D.* x *roundifolia* x *intermedia.* These were very large, and of course, I did not dig them out, although the temptation was overwhelming. Unfortunately, it was too early in the season for seeds, and so this fall I will be collecting seeds.

I am sure that most interested people will agree that there is something about wetlands that draw you in. Though I sink up to my waist in muck, smelled of sphagnum moss, and was attacked by what seemed like monster mosquitoes, I have already made plans for my next trip into this forbidding, but beautiful, wetland.

DANA CRAIG, (American Representative, International Asclepiad Society, 67 Hill Street, Norwood, MA 02062) writes:

I would like to make a suggestion in response to Bob Hanrahan's commentary in the June 1986 *CPN.*

It may be feasible for CPN to purchase bogs to protect CP, but may I suggest that individuals with knowledge of threatened habitats appeal to:

The Nature Conservancy
1800 North Kent Street
Arlington, VA 22209
(703) 841-5300

To quote from their 1985 annual report "The Nature Conservancy is a national conservation organization committed to preserving natural diversity by finding and protecting lands and waters supporting the best examples of all elements of the natural world." They go on to say that since 1951 they have preserved 2.5 million acres in the U.S. and elsewhere in North & South America. I myself have been a member for many

years and recommend them to anyone with an interest in conservation. I am sure they would be interested in hearing from anyone who has specific information concerning threatened habitats.

There are now many field offices, including the Southeast Regional Office at:

P.O. Box 270
Chapel Hill, NC 27514
(919) 967-5493

Perhaps the ICPS could coordinate with them. Wetlands and bogs are disappearing at an alarming rate nationwide.

By the way, the Conservancy now has more than 275,000 members.

JIM EMRICH (1125 Hayes Ave., Fremont, Ohio 43420) writes:

I am writing in hopes that I can provide some topics to cover in future CPN issues. I presently cultivate all my CP in terrariums, so I have run into many problems. First, how does one eliminate grey mold? I get grey mold in spite of keeping plant matter cleaned up etc. I need the dosage of specific fungicides. Can I achieve the acidic condition I need by putting white distilled vinegar in my distilled water? What about Miracid fertilizer at very low doses? Concerning *Nepenthes,* how is one to prune this plant, how often, and I need a diagram to show me the location of the cuts. My *Nepenthes* are out-growing their tarrariums. When I remove the growing tip, the new buds directly below the cut grow very fast and are soon as large as the previous dimensions. I have very large terrariums, but I need instructions on how to make a vining plant into more of a bush.

How about some information on greenhouses, especially sources for plans on homebuilts? How about sources for terrariums, grow bulbs and fixtures? How about more info on distillers, i.e. best make, lowest price? I water all my CP with distilled water.

Since the vast majority of readers are neophytes, how about a rehash of basic cultivation of each specie with emphasis on terrarium grown. How about a profile of our members devoting some space to a brief biography and what they are growing? How about a survey on favorite CP and other basic information such as background, time spent on growing CP and belief in evolution of the plants? Finally, I would like to see future issues spend more time on basic cultivation, to keep a blended format and to include greenhouse ads etc.

ANDY LANIER (901 N. Greene Ave., Lake Worth, Florida 33461) writes:

I'm starting my campaign to try and get some US stamps issued on CP. I'll write to Mary Ann Owens who is on the Citizen's Stamp Advisory Committee. She was the featured speaker at a new issue ceremony for orchid stamps in Miami. A letter writing campaign by members of ICPS would help and I would suggest a set of stamps for the endangered species program that they have.

I am convinced that *Nepenthes* are much hardier than most people believe. I left my plants growing outside since 1978 in a screen enclosure with 40% shade. That is fairly intense light since I live far to the south where the relative humidity is almost always 60% or better, so they don't suffer from low humidity. The plants get red spots on the leaves and the older leaves get rather ragged at times. On really cold nights, I will run a sprinkler under the benches which seems to prevent frost (in the winter before last we had tropical fruit trees killed to the ground and severe damage to palm trees and orchids.) The *Nepenthes* are potted in mostly pure Canadian peat moss with osmunda fiber or tree fern added to the mixture. I repotted most of them three times, and some of them I rooted in pure peat moss and left them there. They are watered with very hard water; however, we get drenching rains here that help to leach out the minerals. Lately, it's been dry with only a half-inch falling last month.

The plants all have pitchers on them now and most bloom every year. I'm growing *N. khasiana, kampotiana, mirabilis, x hookeriana* and a narrow-leaved variety from Peter Pauls Nursery. I never fertilize the plants, as we have plenty of insects here the entire year. Almost every winter we have at least one night when the temperature falls to around the 30 degree mark. The plants don't always look pretty, but they have large, stiff leaves and large pitchers. We have many nights with temperatures in the low 40s and high 30s with no problem. I've never had any

insect pests to bother them except for the normal loss in trying to root cuttings. I've found that I can get almost 100% rooting if I use live sphagnum moss, but only about 50% success in peat moss. Several times I've forgotten to water until the leaves wilted, but a good soaking would return the plant to normal shape with some browning of the leaf edges. The *N. khasiana* plants grow into huge plants in 3 gallon pots with many new growths up to 3 feet long. I tried all kinds of growing media, but the best results have been with 50% peat moss and 50% ground osmunda fiber. Our growing season lasts about 10 months, and even in the other months they still grow but don't put out too many pitchers. Maybe my experience will allay some fears about growing *Nepenthes,* as certainly they are not as delicate as I was led to believe.

PHIL MANN (57 Hoylake Ave., Bunbury, West Australia 6230) writes:

In answer to Mr. Yax in CPN 15 (1) in which he criticized me to the effect of "let's not go out and kill every living thing" shows his little understanding of the Australian bog, let alone its most aggressive inhabitant, the tiger snake. As most of the bogs that I visit are often an hours drive from the nearest town, the dangers of this very poisonous and common snake cause me much concern, and, therefore, I am forced to carry the shotgun. Last season, I encountered no less than 23 tiger snakes, all of which I managed to avoid, except this one. I assume that with the lack of many poisonous snakes in the American bogs, others do not understand our situation. Unfortunately, the CPs and these snakes share the same habitat. I have been involved in conservation since early teens and I have a full understanding of its importance but I place my enjoyment of life and CP collecting before an agonizing death by snake bite. The snake in the article was extremely aggressive and hell bent on striking so there was "no easily walking away!" I wish to thank CPN in their honesty in printing letters as such and also to all those who wrote expressing understanding of the situation. Keep up the good work.

JOE MAZRIMAS, CPN co-editor reports:

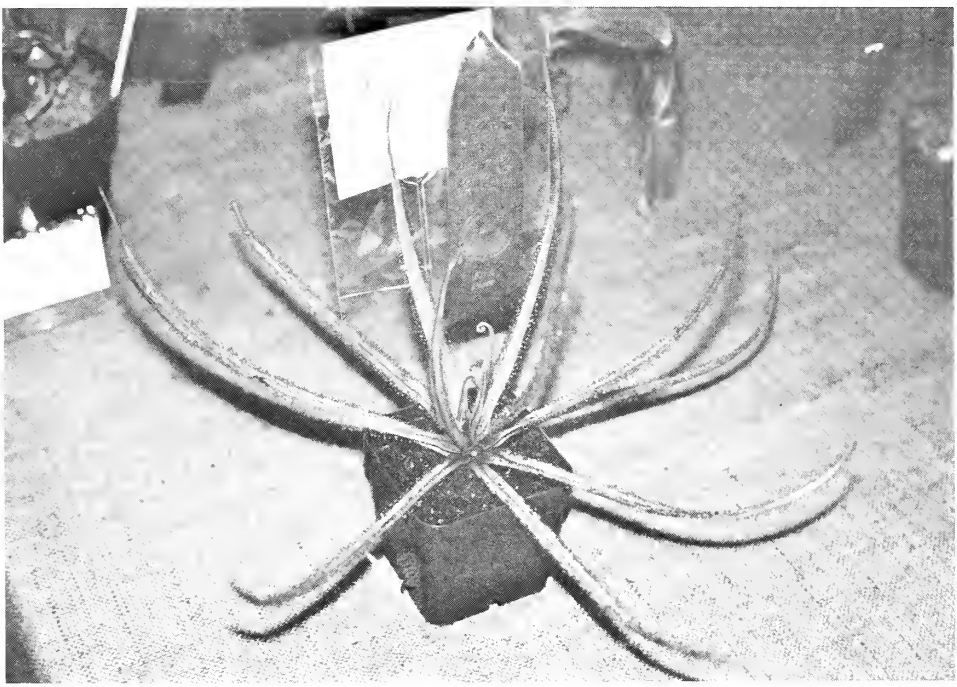
The San Francisco Fair flower show is getting better every year with more and better plants which were exhibited in the central hall. Large crowds of people admired the diversity of CP shown which even included professional photographers taking closeup pictures of the plants for sale. A VCR and TV monitor was set up to periodically show the "Nature" show of "Deathtrap" to the visitors. The show took place August 22-24, 1986 and since this is an annual event in our area, this year's show will occur at approximately the same dates. We urge all local CP growers to participate since we are given plenty of room to display our plants and it's fun to win cash prizes. Write to me for details.

The exhibitors were: myself, Larry Logoteta, Louise Avila, Ray Triplitt, Richard Goodwin, Jeanne Savarese, Mickey Urdea and Marc Stephenson. The plant of *Nepenthes sanguinea* grown by R. Triplitt won Best of Show and L. Logoteta won the Brisbane Award for the best-grown Australian CP of *Cephalotus.* Other CP such as *N. spathulata, N. truncata, N. veitchii* and *N. infundibulensis* were handsomely displayed.

Larry Logoteta won the Brisbane Award for the best grown Australian CP of *Cephalotus.*

Nepenthes vietchii **on display at the San Francisco Fair Flower Show.**

Larry Logoteta won 1st prize for this *Venus* Fly trap specimen.



Ray Triplett won 1st prize for his *Drosera regia* specimen.

There are two new products on the market called HYDRESERVE and BROAD-LEAF P4 which are tiny polymer granules that hold hundreds of times their weight in water. They adhere to plant roots, making water available to plants without causing soggy soil or overwatering. These products are especially useful in container plantings. The pre-moistened granules are mixed with the soil and the manufacturers claim that watering chores are reduced by as much as 75%!! I would like to see these products used for CP, especially terrariums. These products last for years in the soil and are neutral and non-toxic.

LARRY MELLICHAMP, CPN co-editor:

Some of you knew Mr. J.C. Moore, Sr. of Mobile, Alabama and have been asking about what has happened to him lately. I have been corresponding and talking with him since July of 1984. I have visited him twice and hunted for pitcher plants with him. He was becoming very knowledgeable about the plants in his area of Mobile, and took a very keen interest in learning about them, growing them, sharing them, and preserving them. About 6 months ago he suffered a series of strokes, so he told me. He was not recovering well from them and could not talk or typewrite very well, so all correspondence ceased. I heard from him in November, 1986, sent him a Christmas card, and told him in the card that he need not try and respond, but that we were all thinking of him. I received a letter from him in February and am happy to report he is again functional and back to looking at pitcher plants. I named a hybrid *Sarracenia* cultivar after him; it will appear in the June CPN. I have a great deal of data on the plants and habitats which we visited in Mississippi, Alabama, and Florida. No more avid supporter of CP in south Alabama exists.

BRUCE PIERSON, (P.O. Box 179, Albion Park, N.S.W. 2527, Australia) writes:

This year, one of my seedling *S. flavas* flowered for the first time, and I was quite surprised to find that the flower had 9 petals. There were the normal 5 petals in one row, then another row of 4 petals above (or below) these. (I think there is a petal missing from the second row, as I would have expected 10 petals and not 9.)

I have labeled this plant and will observe the flower next year to see how many petals it produces. I have also selfed the flower, and will plant my seed produced and observe if any of the offspring produce abnormal flowers. The parent plant will be observed over a period of several years (assuming it survives of course) to see if, and how often, abnormal flowers are produced. I will keep you informed of the developments.

J.B. STAHLE, SR. (700 Mulberry St., York, PA 17403) sends the following:

"I thought that it might be of value to mention that in *Garden Magazine,* March/April 1986, there appeared an article, "The Nuts and Bolts of Wild Orchid Protection," by Faith Campbell. Of three examples cited for convictions obtained against "diggers" who supply nurseries, one reads:

> 'In New York last summer (1985), a teenager was apprehended while digging orchids and carnivorous plants from a privately protected bog. New York is among the states that have prohibited collection of certain plants and are prosecuting violators. In this case the New York State Department of Environmental Conservation brought charges under the Environmental Conservation Law. The youth paid a fine of $1,200 for 68 illegally dug plants, a surprisingly severe penalty considering the defendant's age, and an indication that New York is serious about efforts to protect its flora.'

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WILLIAM L. TRICKNOR (2827 Middleboro Dr., Falls Church, VA 22042) writes:

This past summer, I picked up a brochure listing the parks in the North Carolina State Park system. One of the pictures in the brochure showed *S. flava,* and the brochure stated that the Carolina Beach State Park was a good spot to see carnivorous plants in the wild. The park is located in the small area where *Dionaea* grows naturally.

I wrote the park for further information and received a polite and thorough response. There is a "Fly Trap Loop" trail, which goes through an area where both *Dionaea* and *Drosera* grow. In addition, *S. flava* and S. purpurea grow in the park, but only can be found *"off the beaten path."* Both *Pinguicula* and *Utricularia* are also found in the park. The letter stated that late May or early June would be the best time to visit to see the plants in bloom.

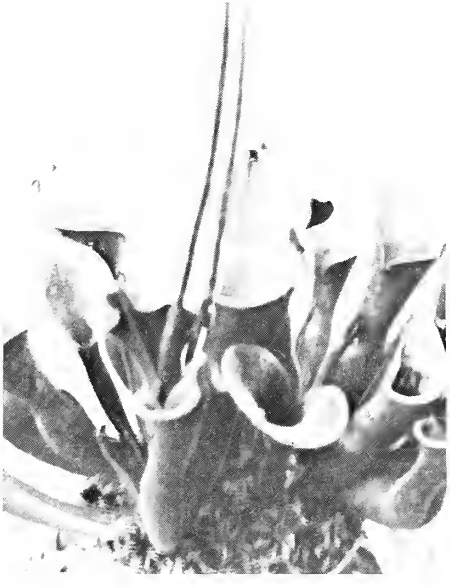
The park is located about 20 miles south of Wilmington on U.S. 421. For further information, the address of the park is:

Carolina Beach State Park
Post Office Box 475
Carolina Beach, North Carolina 28428

D.M. JOEL (Division of Weed Research, Agricultural Research Organization, Newe Ya'ar, P.O. Haifa 31999, Israel) has sent us a photo to print to illustrate the work he, BE Juniper and A. Dafni recently published (New Phytol. (1985) *101:*585-593).

The work concerns photographing representative species of CP under incident light with and without a UV filter (305-385 nm) on the camera. It was disclosed that most CP (the one *Nepenthes* was an exception) had UV absorbance and reflective patterns of their leaves and/or glands reminiscent of many patterns in flowers visible in the insect UV spectrum. Thus, the various UV patterns may serve to attract insect prey. In the *Heliamphora* example shown, UV photography clearly shows that UV absorbance of the external surface and reflectance of the internal surface clearly accentuates the latter in the insect visual light range. Other photos in the paper showing stalked gland leaves (Droseras and Pinguiculas) are even more startling.

Heliamphora nutans: Normal Photography.



Heliamphora nutans: UV Pattern, with UV Filter.

THE NATURE OF PIGMENTATION IN *DIONAEA MUSCIPULA* ELLIS

by Gregory T. Shanos, 160 Budlong Ave., Warwick, R.I. 02888

A mature *Dionaea* plant often develops a blood-red coloration on the inner surface of the traps. (Fig. 1.) The probable function of this pigment is to aid in the luring of prey.[5] The pigment is located in the vacoules of the digestive glands, thus rendering them conspicuous.[2] The alluring or nectar-secreting glands possess no such coloration.[2]

This red pigmentation is due to the presence of an anthrocyanin ([1-4]). Anthrocyanins are not unique to the Venus Flytrap and are distributed universally throughout the plant kingdom.[4] Their presence imparts a characteristic color to the leaf, stem or flower.[4]

The specific anthrocyanin of *Dionaea muscipula* is the secondary metabolite cyanidin-3-glucoside.[1] The chemical structure of this compound is illustrated in Figure 2. Cyanidin-3-glucoside is a flavanoid consisting of two six-carbon aromatic rings linked by a three-carbon unit. ([4,7]) A molecule of glucose is attached beta to the three positions of the flavanoid nucleus.[6] The presence of glucose is partially responsible for the water-soluble nature of the pigment.[4] The flavanoid moiety is also able to ionize depending upon pH, thus further increasing water solubility. ([4,7])

The characteristic color of a particular anthrocyanin is dependent upon the pH of the containment vacoule. Cyanidin-3-glucoside *in vitro* is red in acid solution, violet in a neutral solution, and blue in an alkaline environment.[4] The acidic nature of the digestive enzymes of *Dionaea muscipula* are therefore responsible for the red coloration of cyanidin-3-glucoside *in vivo*.

The color of a mature Venus Flytrap is thus a result of the anthrocyanin pigment cyanidin-3-glucoside. The acidic environment of the digestive enzymes interacts with the pigment to produce a red coloration typical of this carnivorous plant.

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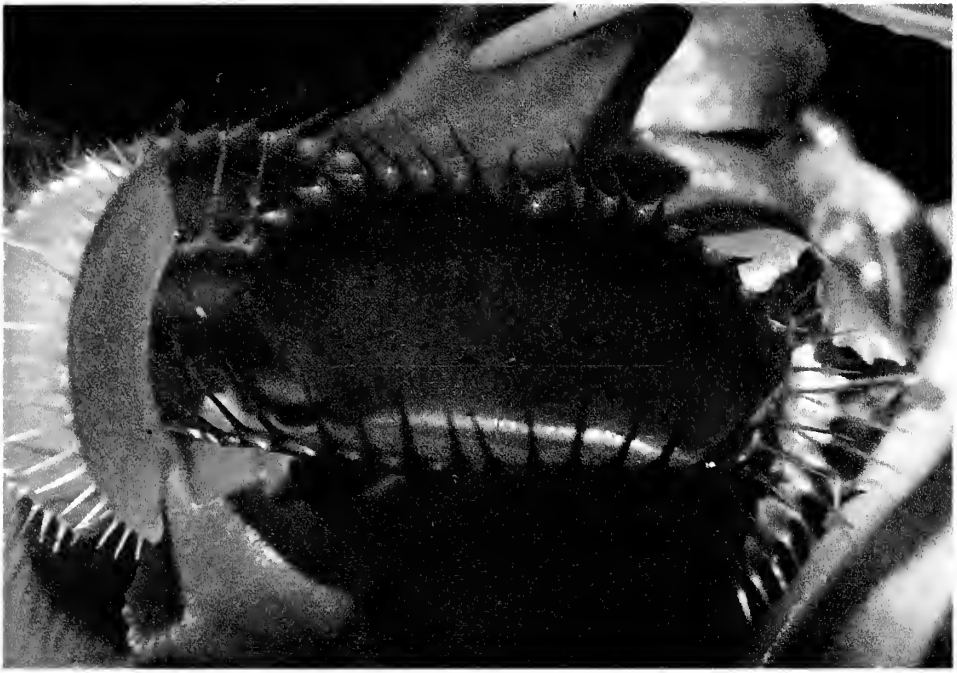
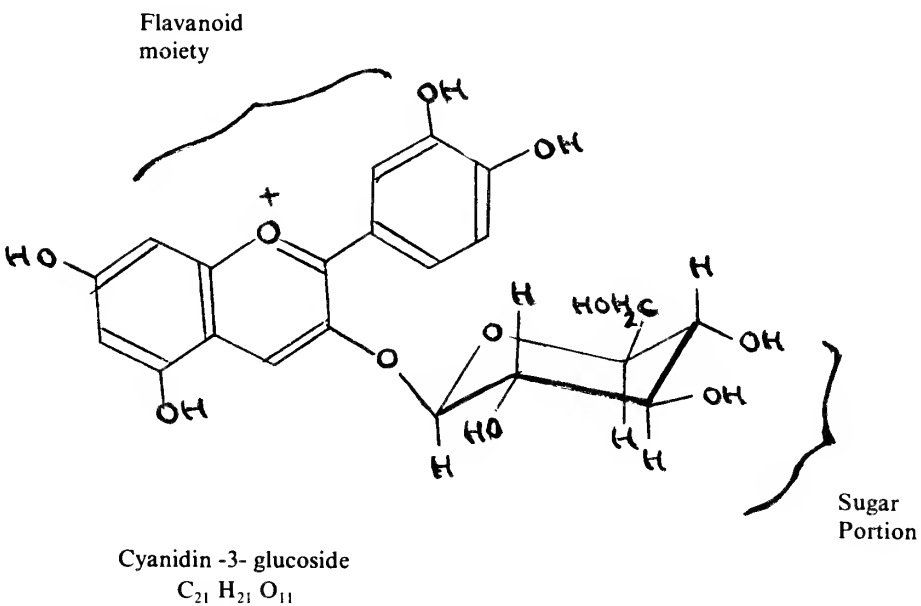


Fig. 1 An anthrocyanin pigment is responsible for the red coloration in mature Venus Flytraps.



Cyanidin -3- glucoside
$C_{21}\ H_{21}\ O_{11}$

Fig. 2 Chemical structure of *Dionaea* anthrocyanin: cyanidin-3-glucoside.

SPECIAL LITERATURE REPORT

By J.A. Mazrimas

Steyermark, J.A. Realignment of the Genus *Heliamophora*, Annals of the Missouri Botanical Garden *71:* 302-312 1984.

In 1978, D. Bassett Maguire published a review (see CPN *8*(3): 82-83 1979 for summary) in which 2 new species, *H. ionasi* and *H. neblinae*, and four varieties were added to *H. nutans, H. heterodoxa, H. minor* and *H. tatei.*

The genus is extremely variable and it is difficult to find characters that are sufficiently constant to distinguish various taxa. Many morphological variations are induced by changes in the environment with water supply and sunlight exposure being the most influential. But certain characters seem to be more or less constant and they are: the relative number and length of the anthers, the total length of the upper pubescent zone of the pitcher's interior and relative length of the hairs in this zone.

A) The number of anthers separate the taxa into two geographical areas: Territorio Federal Amazonas with 15-20 anthers on *H. tatei* and *H. neblinae* and from Estado Bolivar there are 7-15 on *H. minor, H. heterodoxa, H. nutans* and *H. ionasii.*

B) The length of the anthers: small (H. nutans, H. ionasii)
large *(H. heterodoxa, H. tatai, H. neblinae)*

C) In *H. nutans* and *H. minor,* the pubescent zone occupies 1/4-3/8 of the upper pitcher interior surface.

In *H. heterodoxa, H. tatei, H. neblinae,* this zone is 3/8-1/2 the entire length.

D) Minute trichomes are found in *H. nutans, H. heterodoxa, H. tatei* and *H. neblinae.* Longer type of trichomes prevail in *H. ionasi* and *H. minor.*

It is interesting now to turn our attention to the height of the plants which have considerable variation due to environmental conditions. Maximum pitcher lengths are:

	cm	inches
H. minor	5-30	2-12
H. nutans	15-29	6-11.6
H. heterodoxa	12-42	4.8-16.8
H. tatei	25-50	10-20
H. ionasii	40-50	16-20

If you add to this, the overall height of the plant due to the elongation of the cauline axis (the base stem), then *H. tatei* can reach a height of 1-2m (40-80 inches) and in one case 4m or 13 feet!

Finally, the author re-examined the dendroid (branching nature) of *H. tatei* alluded to by Dr. Maguire. In the field, on the summits of Cerro Duida and Cerro Huachamacari where thousands of *H. tatei* grow, the author found many individuals with only a single, solitary stem. Some plants had an abbreviated rosette or leaf cluster along the side of the stem and even near the apex producing a bifurcated plant. But these were in the minority and most were simple, unbranched stems which lack any attached leafy rosettes or leafy clusters.

In conclusion, this isolated genus of 5 species and 7 varieties or forms would appear to be of ancient geological origin. However, the author believes that due to the high degree of variation and overlapping characters, the species separated from one another in only recent times and that divergence is still in the process of sharply differentiating them from one another.

BOGS IN SWITZERLAND AND THE U.S.A.

by Christoph A. Belanger, 3847 Bowling Green Way, Atlanta, Georgia 30340

I have always had the good fortune to live or spend vacations in areas where carnivorous plants are found. I lived with my family in Switzerland until July 1985 and then moved to Atlanta. Before we moved I had found two bogs in our neighborhood. Both bogs were found by accident.

One day in the summer of 1984 I went for a walk and passed a strange looking field near our home in Steinhausen, Zug. The grass was not dark green but sort of brownish looking. I was curious and went into the field and stepped on something soft and spongy which turned out to be sphagnum. I remembered from an article I had read that where there was sphangnum there would also be *Drosera rotundifolia.* As I walked I looked down at the ground to see if there were any plants and it was there that I saw my first *Drosera* in nature.

In April of 1985 I found another bog near Steinhausen. It was a different kind of bog than the one I had found before and was the locale of many beautiful flowers and butterflies. I walked further and saw the largest *Pinguicula vulgaris* I had ever seen. It measured 5½ inches in diameter! Walking still further I saw large patches of ground coverd with *Drosera intermedia* and *Pinguicula vulgaris* which surprised me because they are reported to be very rare.

Those were the only two bogs I encountered in Switzerland and then in July 1985 we moved to Atlanta and I was out of reach of any bogs.

My sister and I were invited to spend a couple of weeks in Covington, Louisiana, in June of 1986 which excited me very much because I knew that *Sarracenia* could be found in its natural habitat there. On June 12, after driving for 5 hours, I saw patches of *Sarracenia leucophylla* just northeast of Mobil, Alabama, growing along the highway. In southern Mississippi I saw a lot of patches of *Sarracenia alata.*

During my second week in Covington my friend and I drove around the area and saw what appeared to be a field where *Sarracenia alata* should be found. After spending a couple of hours and not having found what we wanted we then decided to go back home. On the way back we stopped at a drugstore to get a few things, looked across the road, and from a distance saw some pitchers of *Sarracenia alata.*

Two or three days later we returned to the same field and saw our first wild *Sarracenia* close up. The mouth of one *Sarracenia alata* was 2 inches wide! The plant appeared to be healthy; no pitchers were infested with larva of the Exyra moth and there was a lot of young pitcher growth. We went on and found a drainage ditch and saw submerged in the water *Drosera capillaris.* Further in the field we noticed there were fewer *Sarracenia,* and a lot of the few pitchers we saw were collapsed because of the Exyra moth larva. There was not much young pitcher growth. I took some photographs, and then decided to return to the car because the heat became unbearable and the mosquitos were having a feast—and we had become the main course.

A few days later we went to another field which also contained patches of *Sarracenia alata.* We went into the field and had the refreshing experience that water covered most of the ground and came up to our ankles. As we came to the patches we noticed right away that these plants were much healthier and more robust than the plants we had seen a few days earlier.

While we were examining the plants, crawfish were crawling all over our feet. After seeing what we wanted, we went back to the field we had seen earlier in the week. We were looking for *Drosera brevifolia, Pinguicula* and *Drosera capillaris.*

We walked further than the last time and found a spot where there were hundreds of little *Drosera.* At first we could not identify them because they were so small. I then realized that the size of the plants had caused the confusion between *Drosera capillaris* and *Drosera brevifolia.* They were hardly an inch in diameter. We went further to look for some

(Above) ***Sarracenia alata*** **in natural habitat near Covington, Louisiana**

(Below) ***Drosera rotundifolia*** **in sphagnum bog in Steinhausen, Kanton Zug in Switzerland**
Photos by Christoph A. Belanger

Pinguicula pumila and *Drosera brevifolia.* Unfortunately, we did not find any, nor did we find any other carnivorous plants, probably because it was so dry in the part of the field we visited last. We went back to the car disappointed and thought - maybe another time.

A few days later my sister and I went back to Atlanta, and, once again, I enjoyed the sight of *Sarracenia alata* and *Sarracenia leucophylla* along the highways in southern Mississippi and Alabama.

Note about the author: Christoph is one of CPN's younger enthusiasts. He is 15 years old and has been interested in carnivorous plants since he was 13.

FIELD TRIP TO GASQUET, CALIFORNIA

By Peter D'Amato
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After six months of talking about it, I was off on a six day camping trip to Del Norte County, CP capital of California. Joining me was my friend Charmaine Rable, landscaper and horticulturalist of the resort where I work. On previous vacations I had briefly stopped along Hwy. 199 while on my way to other destinations, just long enough to find one good stand of *Darlingtonia* and *Drosera rotundifolia.* This time, with four days to spend in one location, I hoped to see *Pinquicula macroceras nortensis* and the rumored red-leaved variety, as well as *D. anglica,* a plant I have never seen. Charmaine was familiar with my small, but varied collection of CP, and found it hard to believe such plants actually "grew in the wild." We were in for a frantic holiday, with both disappointments and a totally unexpected surprise.

Del Norte County, in the extreme northwest of California, is the wettest part of the state, receiving as much as 70 to 100 inches of rain from October to May. The summer is generally dry, with warm days and cool, foggy nights. Winter may see some freezing, especially at higher altitudes. CP can survive the dry summers mostly by growing along the many cold water springs, seeps and creeks that are common in the mountainous terrain.

Before even hunting out a campground, we decided to make a quick stop at the one *Darlingtonia* stand I knew of, near the east limit of Gasquet, a town of 400. The highway parallels the Smith River, a turquoise ribbon that winds through the rugged serpentine mountains which are covered with pines and firs. In April the river is rather wild and noisy, a great contrast to the serene wilderness. Rhododendren and azalae brightened the woods with color, and many unusual wildflowers were in bloom. Any *Darlingtonia* stand is impressive to look at; this one was especially so, as the plants were flowering and the early morning light glowed in the puffed hoods as though they were lanterns. The cobras grew densely in an area no more than 200 feet across, where a bubbling cold creek breaks off into streams and seeps. The ground is a base of crushed gravel, with the *Darlingtonia* rooted in a dense, but porous, peat made not of sphagnum, but other decaying mosses and plants. At first sight, most of the peat mounds are crusty dry and sun-warmed, but pushing your finger into it reveals cold wetness a bare inch below the surface. Glittering *D. rotundifolia* carpet the ground, so different from east coast bogs I have seen where this sundew only grows in sphagnum. Here, the bright red plants are barely 1½" across, growing on the "dry" peat, in the wet gravel, on rotting wood, moss covered rocks, and greasy clay overgrown with grasses. Only April, and flower stalks were already pushing above the rosettes. Here *rotundifolia* is dormant only

from November to February. They will continue to flower as late as early October, as I had seen the previous fall. Intermixed with the *Darlingtonia* flowers were dry capsules brimming with seed. They appeared so old I could only presume they were leftovers from the previous year, and how they remained unscattered through winter was beyond me.

We followed the stream on the other side of the highway down a steep, wooded slope towards the river. There were several surprises, one after the other: a campground I hadn't even known existed, some friendly snakes, a mat of shade covered sphagnum, and plenty of *Darlingtonia.* It was strange to see this lonely mat of sphagnum - stranger to see no sundews taking advantage of it. (Sundews came up from this moss when planted at home, apparently remaining dormant longer than those receiving full sun.) A few cobras grew in the sphagnum, and the moss only grew in a ten-foot wide area where the stream was slow moving. We set up camp here. *Darlingtonia* grew thick along a shaded stream not 25 feet from our tents.

The next day we set out to find some *Pinquicula,* and I nearly drove Charmaine crazy with my constant cry of "Seep!" We must have stopped twenty times along roadside cliffs where water trickled and mosses grew, but *Pinquicula* seemed to be elusive. Pretty soon Charmaine was crying out "Seep!" as well. Exhausted after a few hours, we went to the Gasquet ranger station. Although the wall was covered with a botonist's photos of local flora - including butterworts and their location - the rangers looked at us as though we were hunting for *Cannibus,* a local law enforcement problem. But they were friendly and helpful, browsing with us through manuals that covered the rich local wildlife of the region, including many descriptive pages and photos of *Darlingtonia.* They directed us to the location where the photo of *Pinquicula* on the wall was taken, which was old and labeled *"vulgaris."*

There, a few miles up river, we searched and searched, but no butterworts. The river had formed a beautiful canyon, and roaring creeks ran into it. We did find more friendly snakes, alligator lizards locked in prehistoric combat, beautiful ferns and succulents growing side by side. Then a short distance upriver we finally found what we were looking for - but on the other side of the raging waters! With binoculars we were in awe of a spectacular sight: tall cliffs with twenty-foot-wide clumps of *Darlingtonia* hanging in air over the edge, a misting, rainbow-covered waterfall, and hundreds of *Pinquicula macroceras,* their violet flowers teasing us with their safety. We tried to cross the river, fools that we were, and turned back in frustration. Another location had to be found.

And it was found the next day, at Sheep Pen Creek further east towards the Jebediah Smith Redwood State Park. I had recalled photos in CPN of *Pinquicula* taken at the creek and a ranger gave us directions. And there, roadside next to a covered bridge, grew thousands of *P. macroceras ssp. nortensis* in bloom. They were green leaved, growing typically on shaded, moss-covered rock; some were upside down under ledges with water continuously dripping off of them. The leaves, long and narrow, had barely an upturned margin, making the plants look large and flat. The distinctive flowers, with their widely-separated and long, lower corolla lobes, were a richer violet than photos I had seen, and they had a white throat patch and beard. Just a hundred feet away was a beautiful sight. Here the plants grew along a seeping slope of gravelly, clay-like, blue-grey serpentine, soft and as greasy to the touch as the butterworts themselves, without any other plantlife around them. And they were red! Growing in full sun, the leaves were short, triangular, and deeply marooned, some almost a chocolate color. The contrast of their violet flowers with white throats against the background rosette of bloody leaves made them seem an alien species.

And an alien species was indeed what we found on the surprising last day of our trip. Back at our campsite, our first ironic surprise was a tiny colony of red-leaved *P. macroceras nortensis* growing a stone's throw from camp, right on the highway near the *Darlingtonia* patch. Under our noses all the time; CP will do that to you.

But the biggest surprise was back in the Cobra stand. Charmaine, by now as obsessed as any veteren CPer, was crawling on hands and knees studying *rotundifolia* with a magnifying

(Continued on page 20)

CARNIVOROUS PLANT EVOLUTION

Family Lentibulariacea

by Ivan Snyder, 110 Meyer Court, Hermosa Beach, CA 90254

Carnivorous plant evolution has been a mystery for a long time. This is because it is difficult to see how such complex structures could arise on a plant, when it seems there is nothing on a plant that could possibly become a trap. How could a leaf grow tentacles, or become a pitcher, or a flytrap? How could a root become a bladder trap when it seems anything in between a root and a bladder trap would be disastrous for the plant? The answer is that this is misleading. There are intermediate steps that can be advantageous for certain purposes, and structures have not developed from something that was not already there. Even noncarnivorous plants contain within their genetic blueprints the traits needed for traps. Modification and recombination of already existing genes brought about their carnivorous habit.

The butterworts evolved from a noncarnivorous plant that favored wet ground and had sticky, gland-tipped hairs covering its leaves to discourage plant-eating animals. This plant first became carnivorous when a mutation occurred which relocated a gene that controlled the manufacture of protein-dissolving enzyme to the glandular hairs. This gene was originally expressed in the seed, where the embryonic plant used the enzyme to break down food sources stored in the endosperm. With this mutation the plant became able to digest small insects that would sometimes be ensnared by the sticky glands on the leaves. The insect's soft tissues would be digested by the enzymes in the glandular secretions and absorbed through the leaves. Proteins that make up the insect's body contain nutrients which the butterwort needs and which are low in the type of environment that the plant lives. With these made more available, survival is easier. Offspring carried on this trait, and following generations improved the insect capturing and devouring ability. They did this by evolving separate glands that produce enzyme only. These glands developed from modified mucilage glands that lost their stalks to rest on the leaf surface. The enzyme glands produce enzyme when excited by the capture of insects and are responsible for absorption. Another ability acquired by the butterwort is the capability of bending its leaves around digesting prey. This was better for holding and assimilating the resultant fluid. This capacity was adapted from the plants ability to bend toward light. The phototropic response became modified so that the leaf bent in reaction to protein instead of light.

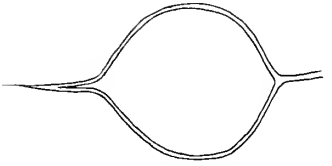
It is evident from the study of floral anatomy that general *Pinguicula, Genlisea, Polypompholyx* and *Utricularia* are closely related. They have all been grouped together in a single family: Lentibulariaceae. The butterwort, genus *Pinguicula,* has the least complex trapping method of its family. This plant, I believe, gave rise to all its more complicated carnivorous relatives.

Butterworts grow on wet ground, often near bodies of water, also around springs on rocks. At one time, long ago, a genetic accident produced air spaces in a butterwort's roots. These cavities became very advantageous when they enlarged into floats, like those seen on some seaweeds. The float bladders kept the plant more buoyant when it was washed into the water. The butterwort could then grow on the water surface where there was less competition for growing space.

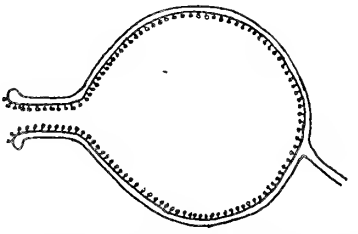
A butterwort of this kind was later affected by another mutation that relocated glandular hairs and enzyme glands to the inner surface of the float bladders. Plants that acquired this trait benefited when small aquatic animals found their way into the bladders and became digested and absorbed in the same manner as if they had been trapped by the butterwort leaf.

Stages of Bladder Elaboration

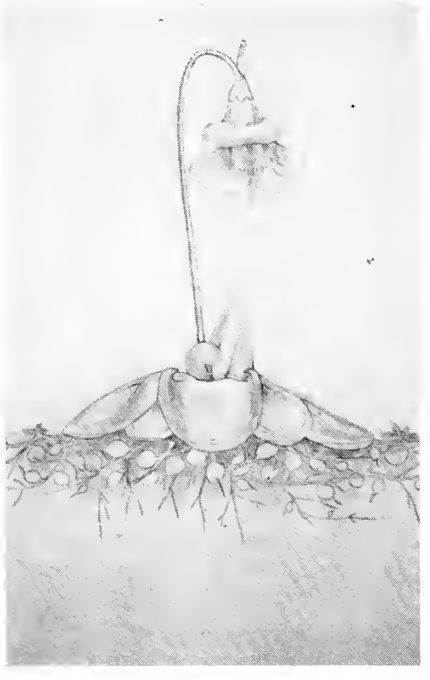
Drawings by Ivan Snyder



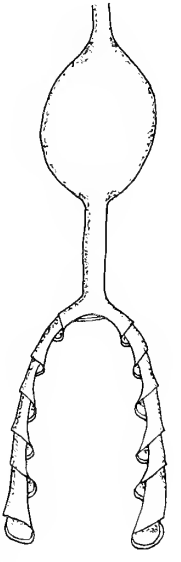
A. Float bladder



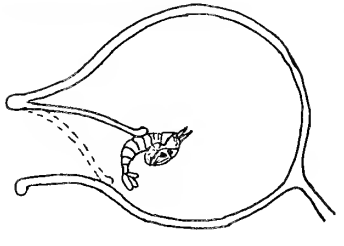
B. Float bladder with translocated glands



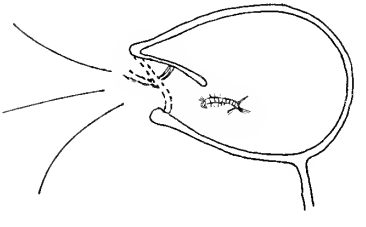
(see description bottom p. 19)



C. Genlisea



D. Trap bladder with oneway door



E. Vacuum trap bladder with trigger hairs on door

This new trapping device developed a good passageway into itself and proved to be very efficient. Aquatic animals are much more available than flying insects. Bladder traps were so much better that butterwort leaves were no longer necessary, in fact were a burden. Primitive bladderworts lost the gluey trap on their leaves and developed smaller leaves, more easily kept above water. Some plants in the proper area found it suitable to grow beneath the water, with only the flower above. A plant such as this, advanced in its trap mechanism, came to be *Genlisea.*

Among the primordial bladderworts evolving, some formed oneway doors on their bladders. These doors easily pushed open to let animals enter, but prevented the animal's escape. Natural selection favored bladders with doors, which allowed animals to pass with least difficulty. Mutations caused recombination of genetic material and gave the bladders the ability to alter turgor pressure in some of its cells when touched. Cellular turgor is controlled in the plants phototropic response to make possible the ability to bend toward light. When this became relocated to the walls of the bladders, the bladders could warp and produce a vacuum in the trap. The vacuum would suck animals through the door and into the trap. With time, specialized cells developed into the trigger hairs on the bladder door to signal when they received tactile stimulation.

The bladderworts are a very diverse group. They have evolvd as aquatic, terrestrial and epiphytic plants. Their great success in nature reflects the effectiveness of their trapping mechanism. The bladder traps are the most complex of all the carnivorous plants. Their evolution is difficult to explain without easily recognized steps in increase of complexity leading up to them. To write this article I compared the most advanced, and most simple, features shared by the carnivors to hypothesize the most logical evolutionary scheme. A few of the facts that have led me to believe the ideas expressed in this article are: *Utricularia pubescens* has mucilage glands on its leaf surface. This suggests it may have once had butterwort leaves. Bladderworts have mucilage glands on their bladders. This shows they may have become relocated from the leaves. Aquatic bladderworts use their bladders not only for trapping, but also in floatation. *U. inflata* even has inflated structures for floatation other than its bladders. It is reasonable a butterwort could benefit having air bladders on its roots because of the plant's proximity to water. Perhaps such a plant still exists and awaits discovery.

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Ching, T.M., Metabolism of Germinating Seeds, chap. 2 pp. 103-218. In: Seed Biology. T.T. Kozlowski, ed. Vol. 2. New York, Academic Press. 1972

Ivan Snyder, CPN 14(4): 108-109, 1985. Evolution of the Venus Fly Trap

Illustration page 18: Butterwort with float bladders. Depiction of possible evolutionary intermediate linking butterworts to bladderworts.

Illustration by Ivan Snyder. Photo by Bob Mallloux

REVIEW OF RECENT LITERATURE

Ayuga, C.E., E. Carretero & P. Bermejo. Contribution to the study of flavonoids in *Drosera rotundifolia*. An. R. Acad. Farm. *51* (2): 321-326. 1985.

The authors continue to identify new compounds of the flavonoid type which could be used for identification.

Damtoft, S., S.R. Jensen & B.J. Nielsen. Iridoid glucosides from *Utricularia australis* and *Pinguicula vulgaris* (Lentibulariaceae). Phytochemistry (Oxf) *24*(10): 2281-2284. 1985.

The authors found similar iridoid compounds in both of the above species in this family.

Farkas, M.J. and R.A. Brust. Phenology of the mosquito *Wyeomysia smithii* in Manitoba and Ontario Canada. Can. J. Zool. *64*(2): 285-290. 1986.

The water-filled pitchers of *S. purpurea* were studied in bogs near The Pas and Patricia Beach, Manitoba, and Kenora, Ontario. Larvae enter a third-instar diapause by mid-August and remain over the winter until the following spring. Survival over the winter was about 9% to 68% in one winter and about 50% in another season. Winter snow insulates the larvae at these sites. A small percentage of the summer generation at each site continued their development to adults and give rise to another generation.

Joel, D.M. and H.S. Heide-Jorgensen. Ultrastructure and development of the pitcher epithelium of *Sarracenia*. Isr. J. Bot. *34*(2-4): 331-350. 1985.

The bottom zone cells of this pitcher plant have dense cytoplasm, a large nucleus and many mitochondria and chloroplasts. The hypodermal cells have simple pits traversed by many plasmodesmata that connect each hypodermal cell with the neighboring rectangular epidermal cell, hypodermal and mesophyll cells.

Nicholls, K.W., B.A. Bohm & R. Ornduff. flavanoids and affinities of the Cephalotaceae. Biochem. Syst. Ecol. *13*(3): 261-264. 1985.

The flavonol-based chemical profile found in *Cephalotus* resembles the profile

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FIELD TRIP TO GASQUET (Cont'd. from page 16.)

glass. And so was I, when suddenly to my shock I saw a cluster of about ten giant-sized sundews! *"Drosera capensis!"* I cried. In Gasquet? "No! It must be *anglica!* Can't be! Is it some transplanted hybrid? *Anglica x filiformis? x linearis?* Some new, unknown species?" I was baffled. The attractive plants, growing on short stalks, had extremely narrow petiholes, as long as the thin leafblade, covered with bright red tenticles. The entire plant was over 7 inches across. We scoured the area, but we could find no others. I examined the peat it grew in for signs of a transplant. It was an unfamiliar tan muck, but the plants could have come up from root-cuttings or seed. I wondered why, if put there by some CPer, no other species were tried. Perhaps they were, but were better hidden. I collected two plants, then took leaf cuttings and pressed them into the peat where they grew so more would multiply. And I wondered what they were the whole trip home.

Back in Sonoma County, I called Joe Mazrimas and described the plant to him. "Sounds like *Drosera capensis* narrow-leaf," he told me. So my first guess was right. "They survive the winters up there?" I asked. "They'll survive just about anything!" Joe laughed. I had never seen the true narrow-leaf variety of *capensis*, even though I grew for a local nursery, plants cloned from an original (what I thought to be capensis N.L.) purchased a few years ago that were sold under the narrow-leaf name. I'm surprised at the variation and the hardiness. Even though I never did find any *D. anglica* on this trip, it certainly was exciting.

Joe also told me that the red-leaved butterworts loose their color when moved from their native habitat. From the couple of plants now in my collection, he was right about that as well.

So to whoever planted cape sundews in Gasquet (and he or she may well be reading this), the plants are doing just fine, and my apologies for taking a couple of them. By this time next year, I'm sure there will be a few dozen more.

of the Saxifragaceae more than it does the Crassulaceae. Morphological features also suggests it is most closely allied to that family.

Ruiz, S.Z. and J. Rzedowski. Three new *Pinguicula* species (Lentibulariaceae) of Mexico. Phytologia *60*(4): 255-263. 1986.

The three new species of *Pinguicula* are:
P. barbata from Chiapas
P. emarginata from Veracruz and Puebla
P. takakii from San Luis Potosi

Sheridan, Phil. 1986. The Sarraceniaceae of Virginia. Virginia J. Science. *37:* 83. (Abstract of paper presented at Virginia Academy of Science, May, 1986).

The current and historical ranges for *Sarracenia flava* and *S. purpurea* were analyzed over a two-year period based on field work, personal interviews, bibliographic searches and herbarium specimens. *S. flava* was found to have occurred in eight counties for a total of seventeen locations. Three sites were relocated in three counties, and two new ones found. *S. purpurea* ranged over 14 counties with 19 populations. Three historical locations were refound in three counties with four new colonies in one county. Color variants were noted, and the ideal habitat was a springhead. Recommended status for both species in the State is threatened. DES

Teryokhin, E.S. 1986. The development and structure of the *Aldrovanda vesiculosa* (Droseraceae) seed. Bot. Journ. *71:* 527-533. /Russian, Leningrad./

Embryogenesis of *Aldrovanda, Dionaea* and *Drosera* is similar. The seed of *Aldrovanda* is possessed of a thick seed coat of 3 layers. The storage tissue (endosperm) fills about 2/3 of the seed volume. Cotyledons, apex and hypocotyl are morphologically indieated, but no anatomical signs of primary root are present in the embryo. ST.

Zavortink, T.J. *Zinzala,* new subgenus of *Wyeomyia* with two new species from pitcher plants in Venezuela. Wasmann. J. Biol. *43*(1/2): 46-59. 1985.

The immature stages of the mosquitoes *W. zinzala* and *W. fishi* inhabit the leaves of the *Heliamphora* pitchers found in the Gran Sabana region of Venezuela.

DROSERA ANGLICA FROM THE ALAKAI SWAMP, KAUAI, HAWAII

by J.A. Mazrimas

On the oldest island of the Hawaiian chain, stands an old 5,148 foot extinct volcano, Mt. Waialeale. At the base of this volcano is a 30 square-mile bog which is constantly being rained on throughout the year. This area receives more than 460 inches of annual rainfall and is noted as one of the wettest places on earth. In this bog one can find many unusual flora and fauna which are either very rare or became extinct due to man's predation. However, we are fortunate to still have in the Alakai bog the small, herbaceous plant called *Drosera anglica.*

Several years ago I acquired a few plants from a friend who visited this area. The plants were carefully adjusted into some Canadian sphagnum peat moss and kept evenly moist in my tropical greenhouse. They grew vigorously and seemed to flower throughout the spring and summer season. The flowers produced seed on their own and the seed germinated into tiny plantlets after several weeks. I found by experimentation that the plants do not form hibernicula to carry them over the cold, winter frost and snows as do the North American types. The plant growth slows down and even seems to stop during the winter despite the warm temperatures and artificial lights extending the daylight hours. I'm almost tempted to think that this plant is an annual, producing copious seed to assure its continuance in the bog. Plants in cultivation seem to die off during the winter. *(Cont'd. next page)*

The plant can also be propagated from leaf cuttings which are pressed firmly on the peat moss medium and carefully watered to keep evenly moist. Small buds emerge after several weeks which grow into mature, flowering plants the following season.

When compared with N. American plants, the Hawaiian *Drosera* is about one-half the size in all its parts. It is an interesting species to grow because it is easier to grow this plant in a terrarium or warm greenhouse, and it grows over a long season with plenty of flowers throughout its growing cycle. This is not true with the N. American type which flowers only once in spring and tends to go into dormancy after 4-5 months. I am propagating this plant to obtain seed which will be sent to our seed bank in the near future and available for CPN members who ask for it.

SEED BANK

Patrick Dwyer (St. Michael's Episcopal Church, 49 Killean Park, Albany, NY 12205)

To send seed: Please remove seed from the seed capsules and place it in small envelopes (preferably paper so that they dry out enough to prevent mold). Label with the origin and date of collection, including habitat if it is exotic. Fold the envelope once or twice before taping so that the seeds don't stick to the tape. After the seed is received it will be placed in smaller packets; donors will be informed of how many packets they have donated. A donation of 10-19 packets earns one free seed packet of comparable rarity, with one additional free packet for each additional 10 packets.

Do not ask to trade for seed from the bank. Everyone will have to buy all but the free packets.

To order seed: Please enclose payment. List the seeds desired and an equal number of substitutes in order of preference. If requested, Patrick will add any cultural instructions of which he is aware. Each issue of CPN will include an update of the inventory. Cost per packet: $.75 (Number of packets is listed if less than 15 are available.)

(as of 12/25/86)

Byblis liniflora (10), *Capsella bursa-pastoris* [carn. seed] (13), *Darlingtonia californica, Dionaea muscipula, Drosera aliciae, D. anglica* (10), *D. auriculata* (3), *D. binata* (5), *D. binata multifida extrema* (2), *D. burkeana, D. burmannii, D. capensis, D. capensis* [narrow leaf], *D. capensis* [wide leaf], *D. capensis* [mix], *D. capillaris* (4), *D. cuneifolia* (4), *D. dielsiana, D. filiformis* (3), *D. filiformis, D. filiformis filiformis* x *D. filiformis tracyi* (1), *D. gladuligera* (4), *D. indica* (10), *D. intermedia, D. intermedia maxima* [Gulf Coast], *D. macrantha, D. montana* (3), *D. montana* [white fls.] (3), *D. natalensis* (3), *D. pulchella* (1), *D. pygmaea* (1), *D. rotundifolia, D. spathulata* (6), *D. spathulata* [Formosa] (1), *D. spathulata* [Kansai] (10), *D. spathulata* [Kanto] (1), *D. spathulata* [New Zealand] (1), *spathulata* [white fls.] (1), *D. stolonifera* (15), *D. trinervia* (4), *D. villosa* (6), *D. whittakeri* (7), *Drosophyllum lusitanicum* (4), *Nepenthes bicalcarata* (4), *N. khasiana, Pinguicula agnata* (3), *P. alpina, P. lusitanica* (10), *P. macroceras nortensis* (3), *P. moranensis* (3), *Sarracenia alata, S. flava* (1), *S. flava* [green] (6), *S. flava* [Green Swamp] (3), *S. flava* [mixed strains] (5), *S. leucophylla, S. minor* (10), *S. psittacina* [Gulf] (1), *S. purpurea, S. purpurea* [Gulf Coast] (3), *S. purpurea* [NJ-MD], *S. purpurea purpurea, S. purpurea venosa* 'Louis Burk', *S. rubra gulfensis* (5), *S. rubra jonesii* (1), *S. rubra wherryi, Utricularia aurea* (12), *U. capensis* (4), *U. lateriflora, U. longifolia* (1), *U. pentadactyla* (7), *U. racemosa* (12), *U. subulata, U. ulignosa* (4).

SARRACENIA HYBRIDS

flavaleuco [Gulf], *purpurea* 'Louis Burk' x *flava* [red] (1), *psitt/purp* x *minor, flava* x *leuco/purp* (2), *purp* x *flava* x *alata* (2), *oreo/psitt* x *leuco* (4), *leuco/minor* x *rubra* (1), *(purp* x *flava)* x self (7), *oreo/minor* x *psitt/oreo* (1), *oreo* x *purp purp* (6), *leuco* [dk] x *flava* [red tube/green lid] (10), *alata* [red throat] x *flava* [red tie/green lid] (6), *rubra gulfensis/leuco* x

leuco/minor (1), *alata* x *leuco* (3), *purpurea* hybrid, *minor* hybrid, *psitt/purp* x *rubra* (3), *purp/psitt* x *minor* x *alata/minor* (4), *rubra-gulfensis/leuco* x *leuco/minor* (4), *psitt/purp* x *minor* x *psitt/rubra* x *leuco* (4), *oreo/alata* (13), *purp-venosa/leuco* (7), *alata* [red] x *oreo/alata* (7), *alata/minor* (5), *leuco/purp* (6), *flava* x *purp* (6), *flava* x *purp* (11), *rubra-gulf.* x *leuco* (3), *leuco/minor* x *psitt/oreo* (2), *rubra-gulf.* x *psitt (2), leuco* x *rubra-wherryi* (2), *wrigleyana* x *minor* [Okee. giant] (2), *leuco* x *minor* [Okee. giant] x *psitt* (5), *rubra-jonesii* x *purp-purp* (4), *leuco* [dark] x *purp-purp* (3), *leuco* x *flava* (5), *wrigleyana* x *excellens* (6), *leuco* [dark] x *flava* [hvy vein] (4), *rubra-jonesii* [yellow fls] x *psitt* (2), *rubra-rubra* x *flava* [hvy vein] x *flava* [red tube/green lid] (3), *rubra-gulf.* x *flava* [red tube/green lid] (3), *oreo* x *leuco* [yellow fls] x *alata* [red thrt] x *flava* [red tube/green lid] (1), *alata* [red thrt] x *psitt* (3), *leuco* x *purp-purp* (2), *courtii* x *flava* [red tube/green lid] (2), *oreo* x *flava* [red tube/green lid] (3), *leuco* [dark] x *flava* [rugelii] (8), *leuco* [yellow fls] x *flava* [rugelii] (6), *purp-purp* x *psitt* x *flava* [hvy vein] (2), *flava* [red tube] x *leuco* (10), *flava* [red tube] x *leuco* [yellow fls] (8), *excellens* x *formosa* (3), *alata* [red thrt] x *leuco* [yellow fls] (14), *leuco* [yellow fls] x *flava* [hvy vein] (6), *courtii* x *mooreana* [dark form] (4).

A total of $200 was received from Patrick Dwyer. Keep those seeds coming.

THE 1987 LIST OF CP BOOKS

Not available through *CPN*. Order directly from publisher or your local bookshop.

* = Books intended primarily for children.
□ = Books out-of-print

1. Carnivorous Plants, Gordon Cheers, Globe Press, Melbourne, $7.95.
2. Insectivorous Plants, Charles Darwin, AMS Press, 1893, 56 E. 13th St., N.Y., NY 10003, Vol. 12, 1972, $42.50.
3. *Plants that Eat Insects: A Look At Carnivorous Plants, Anabel Dean, Lerner Publications, 1977, 241 First Avenue, Minneapolis, MN 55401. $5.95.
4. Plants of Prey in Australia, Rica Erickson, Univ. of W.A. Press, 1968, World Insectivorous Plants, 2130 Meadowind Ln., Marietta, GA 30062, Cloth, $16.00.
5. □ *Animals & Plants That Trap, Phillip Goldstein, Holiday, 1974, Holiday House, Inc., 18 E. 53rd St., N.Y., NY 10022, $5.95.
6. Nepenthes of Mt. Kinabalu (in English), Kurata, S., Sabah National Park, World Insectivorous Plants, 2130 Meadowind Ln., Marietta, GA 30062, $7.50.
7. *Pitcher Plants, Carol Lerner, William Morrow & Co., N.Y. $11.00.
8. Carnivorous Plants, Franeis E. Lloyd, Peter Smith, 6 Lexington Ave., Magnolia, MA 01930, $16.00, 1942 ed., paper $7.95, Dover Publns., 31 E. 2nd St., Mineola, NY 11501.
9. The World of Carnivorous Plants, J. and P. Pietropaolo, R.J. Stoneridge, Peter Pauls Nurseries, 1974, $8.95.
10. □ *Insect-Eating Plants, L. and G. Poole, T.Y. Crowell, 1963, 666 Fifth Avenue, N.Y., 10003, $4.50
11. *Plants That Eat Animals, J.H. Prince, Lodestar Bks., 2 Park Ave., N.Y., NY 10016, $8.95, 1979 ed.
12. CP of the U.S. and Canada, D.E. Schnell, John F. Blair, Pulisher, 1976, 1406 Plaza Dr., SW, Winston-Salem, NC 27103, $19.95 plus shipping, 1976 ed.
13. Carnivorous Plants, Randall Schwartz, Avon Books, 1975, 959 Eighth Ave., N.Y., NY 10019, soft cover $1.25.
14. Pitcher Plants of Peninsular Malaysia & Singapore, Roger G. Shivas, Maruzen Asia Pte. Ltd., 51 Aver Rajah Crescent #07-09, Singapore 0513. $9.80.
15. Carnivorous Plants, Adrian Slack, MIT Press, 1979, 28 Carleton St., Cambridge, MA 02142, $28.00, 1980 ed., 1984 paper $12.50.
16. □ Cultivating Carnivorous Plants, Allen Swenson, Doubleday & Co., 1977. Garden City, NY 11535, $7.95.
17. □ *Carnivorous Plants, John F. Waters, Franklin Watts, Inc., 1974, 845 Third Avenue, N.Y., NY 10022, $4.90.
18. *Carnivorous Plants, Cynthia Overbeck, Lerner Publications, 1982, 241 First Avenue, Minneapolis, MN 55401, $12.95.
19. *Secrets of the Venus' Fly Trap, Je rome Wexler, Dodd, Mead & Co., 1981, 79 Madison Ave,., N.Y., NY 10016, $9.95.
20. The Carnivorous Plants of the World, J. and P. Pietropaolo, Timber, Peter Pauls Nurseries, 1986, $30.30.
21. Insect-Eating Plants & How to Grow Them, Adrian Slack, (Alpha Bks.), Interbook, 1986, $9.95.
22. Common Marsh, Underwater and Floating Leaved Plants of the United States and Canada, Neil Hotchkiss, 1972, Paperbook, World Insectivorous Plants, 2130 Meadowind Ln., Marietta, GA 30062, $7.00.

1987 CP SOURCES

Note: All individuals or organizations selling, trading, or buying CP are advised to be cognizant of certain restrictions under the U.S. ESA and international CITES for certain species (see editorial, CPN *12 3*, 1983).

Name and Address	Catalog Price	Stock
Cyril G. Brown 65 Highfield Cres. Hornchurch Exex RM 126PX		
Burleigh Park Orchid Nursery Ian & Pat Walters, 1419 Ross River Road, Kelso, TOWNSVILLE, QLD. 4815. Phone: 077 740008.		*Nepenthes*
Carnivorous Gardens P.O. Box 318 Acacia Ridge 4110 Brisbane, Queensland Australia	$ .75	*Native Seed*
The Straits Aquariums Pte. Ltd. Lim Ah Pin Road Box 626 Singapore, 9154 Tels: 48 17777 & 48 19911	Free	*Malaysian Nepenthes*
Country Hills Greenhouse Rt. 2 Corning, OH 43730	$2.50 refundable with order	*Nepenthes (20 varieties)*
Exoticana Seeds P.O. Box 184 Greytown 3500, South Africa		*Native CP Seed*
Heldon Nurseries Ashbourne Rd. Spath Uttoxeter ST145AD		
Hinode-Kadan Nursery 2735 Nakanogo, Hacijyot	International Reply Coupon	*Byblis, Cephalotus, Drosera, Pinguicula, Nepenthes, Utricularia*
Hachihyo-Island Tokyo 100-16 Japan		
Hungry Plants 1216 Cooper Drive Raleigh, NC 27607 (919) 851-6521	$ .50	*Byblis, Cephalotus, Dionaea, Drosera, Darlingtonia, Nepenthes, Pinguicula, Roridula, Sarracenia, Sphagnum and Utricularia. Tissue cultures of most stock.*
Marston Exotics Spring Gardens Frome Somerset, England Street 42192	50 p	*Aldrovanda, Byblis, Cephalotus, Darlingtonia, Dionaea, Drosera, Nepenthes, Pinguicula, Sarracenia, Utricularia, Seed.*
Lee's Botanical Gardens 12731 SW 14th St. Miami, FL 33184 (305) 223-0496	Free	*B-S-T All Varieties of CPs*
Cedar Ridge Nurseries R.D. #1, Cedar Ridge RD. Allison Park, PA 15101 (412) 443-9073	Free	*Nepenthes*
Milingimbi Nursery 69 Pringle Ave. Belrose, NSW 2085 Australia	Free	*Byblis, Cephalotus, Drosera, Dionaea, Nepenthes, Utricularia, Sarracenia, Pinguicula*

Orgel's Orchids Rt. 2, Box 90 Miami, FL 33187 (305) 233-7168	Free	*Byblis, Dionaea, Drosera, Nepenthes, Pinguicula, Sarracenia, Utricularia*
Peter Pauls Nurseries Canandaigua, NY 14424 (716) 394-7397	Free	*Sarracenia, Dionaea, Drosera, Utricularia, Darlingtonia, Nepenthes seed, Pinguicula, live Sphagnum*
ISRA Exotics P.O. Box 1200 B.S.B. Brunei, Borneo, SE Asia	Free	*Nepenthes*
Renate Parsley 8 Langton Rd. Mowbray 7700 South Africa		*Native CP Seed*
Sarracenia Nurseries Links Side Courtland Ave. Mill Hill, London, NW7		
South West Seeds Doug & Vivi Rowland 200 Spring Rd. Kempston, Bedford MK428ND		
Alain Christophe 37, Avenue Turgot 77330 Ozoir-la-Ferriere FRANCE	$7s	*S. African Drosers seed*
Thysanotus-Seed-Mailorder Postfach 44-8109 2800 Bremen 44 West Germany	Inquire	*Byblis, Darlingtonia, Dionaea, Drosera, Drosophyllum, Nepenthes, Pinguicula, Sarracenia, Utricularia*
W.T. Neale & Co., Ltd. B.M. & S. Lamb 16/18 Franklin Rd. Worthing, Sussex, BN132PQ England	Inquire	*Sarracenia, Dionaea, Darlingtonia seed*
Harold Weiner Kaiserstr. 74 3250 Hameln I West Germany	Inquire	*Aldrovanda, Byblis, Cephalotus, Dionaea, Drosophyllum, Drosera, Pinguicula, Sarracenia, Nepenthes*
World Insectivorous Plants P.O. Box 70513 Marietta, GA 30007 (404) 973-1554	$1.00	*Dionaea, Drosera, Drosophyllum, Nepenthes, Sarracenia, Pinguicula, Byblis liniflora, Utricularia*
Marie's Orchids and CP 6400 Cedarbrook Dr. Pinellas Park, FL 33565	Free	*Nepenthes, Heliamphora*
Roy Young 79, Pearcroft Rd. Leyton Stone London, ELL. 44P England (01) 556-8048	1 International Reply Coupon	*Seed of CP*

The co-editors and CPN do not endorse any of the above vendors. This is being provided only as a service to our subscribers. Information correct at time of receipt. Please contact sources directly for further information. Not responsbile for omissions. Inquires for inclusion in future lists should include a catalog/price list of CP available, cost of catalog and address. Send information to J.A. Mazrimas, 329 Helen Way, Livermore, CA 94550.

WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please circle the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:

Arboretum Want Ads
California State University
Fullerton, CA 92634

Thomas Carow (Michelsgrundweg 22, D-8732 Münnerstadt, West Germany) (T) *Genlisea hispidula, G. violacea, G. repens, G. pygmaea, G. aurea, G. filiformis* for other *Genlisea. Drosera regia* for *Aldrovanda* and *D. petiolaris. Drosera gramminifolia for D. falconeri* and *D. flexicaulis. Pinguicula ramosa* for *P. lignicola. Drosera chrysolepsis, Roridula dentata, Drosera alba, Heliamphora minor, nutans, heterodoxa* for *Nepenthes rajas.* (WTB) Fresh seed of *Sarracenia leucophylla, S. purpurea, Darlingtonia* and *Sarracenia* Hybrids, about 20 large seed pods each item only from cultured plants. Please give your price. Have *Sarracenia purpurea ssp. heterophylla, S. rubra* 'all green' and *Drosera regia* for trade.

Alan Hindle (22 High Ridge, Godalming, Surrey, GU7 1YE, England). (W) collector only of *Sarracenia* species, ssp., forms and variants wishes to purchase any interesting forms etc. and particularly the following plants: *Rubra jonesii* typical and *heterophylla* forms. *Rubra* chatham giant, *flava* all-red form, *flava* red-tube, green-lid, *flava* copper/red top, *purpurea Venosa chipola, purpurea purpurea L. heterophylla, minor* "Okefenokee" / giant form, *leucophylla alba,* any pubescent forms (except *alata).* Please note: All costs incurred in replying to this advertisement. will be reimbursed in full.

Jerry A. Phelps (6013 Innes Trace Rd., Louisville, KY 40222.) (WB) *Heliamphora tatei, Heliamphora ionasi.* Quinton Tuggle (1087 Bremen - Mt. Zion Rd., Waco, GA 30182). (WB) *Sarracenia flava* (copper top) (WB) *sarracenia flava* (all red form) (WB) *sarracenia flava* (red tube -green lid) (WB) *sarracenia flava maxima* (WB) *sarracenia alata* (red lid form) (WB) *sarracenia flava* all green form (WB) *sarracenia rubra, ssp. alabamensis* (WB) *sarracenia purpurea forma heterophylla* (WB) *sarracenia flava* rugelii (WB) any *sarracenia* hybrids.

Tom van Hunenstijn (5733 Mayview Circle, Burnaby, B.C., Canada, V5E-4B7) (WB) Any species of *Heliamphora,* established plants and seeds. (WB) Any species of *Nepenthes.* (WB) *Cephalotus.* Send me your price.

REMINDER

While the editors are very interested in looking at color prints of your plants, this medium is not suitable for reproduction in CPN. Results are noticeably better with color transparancies (slides); therefore, the editors prefer them over prints.

In taking pictures of your plants, keep in mind that CPN can use vertical shots very nicely as quarter or whole page photos (see p. 71). Horizontal shots are used as half-page photos.

Black and white photos are very welcome as long as they have good contrast and focus.

Please send **duplicate** slides.

Call for papers for future issues.

1. Artificial hybrids in *Pinguicula* with color slides of flowers and plants.
2. Culture of *Genlisea* with color slides (in cultuvation and/or habitat in flower).

World Carnivorous Plant List note: In the combined September/December 1986 issue of CPN — the new **World Carnivorous Plant List** — the names that appear in **Bold Print** are the valid species.

BACK COVER

"TWENTIETH CENTURY BOTANISTS and their Carnivorous Plants"

Nepenthes - John M. Macfarlane (American, 1855-1943)

Utricularia - Peter Taylor (British, living) (Drawing by Ron Fleming, from CPN)

Pinguicula - Siegfried J. Casper (German, living) (Drawing by David Kutt, from CPN)

Sarracenia - Edgar T. Wherry (American, 1885-1982) (Drawing by R.S. Bennett, from CPN)

Cover produced by Larry Mellichamp, University of North Carolina at Charlotte.

"Photos courtesy of Hunt Institute, Carnegie-Mellon University, Pittsburgh, PA U.S.A."

TWENTIETH CENTURY BOTANISTS and their CARNIVOROUS PLANTS

Nepenthes I.M. MACFARLANE

Utricularia P. TAYLOR

E.T. WHERRY

Pinguicula S.J. CASPER

Sarracenia